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Seasonal Corn Price Differentials in the Cincinnati and Toledo Markets

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INTRODUCTION

For many years, parts of Ohio have produced more corn than could be consumed by Ohio feeders and processors. The need to market this surplus grain at the maximum price advantage is a problem for farmers and elevator operators. This problem has been amplified by the development of the St. Lawrence Seaway, the adoption of trainload rates for marketing grain into the growing export market, and geographical shifts in the U. S. livestock feeding industry.

As a result of these changes, the surplus grain producing areas of Ohio are now operating under the competitive market influence of two separate and distinct markets. The first of these is the U. S. domestic market which is represented by the food and feed grain processing firms. Most notable of these domestic markets is the Northeastern U. S., which is actively bidding for the surplus feed grains, especially after the harvest season. The other principal domestic market area is the Southeastern and Southern U. S. which recently has become an important poultry, dairy, and livestock producing area. Hence, this area has been steadily increasing its demand for Ohio corn during the last 20 years.

The second important market for Ohio surplus grain is the export market represented by the port of Toledo when the waterway is in operation and the ports on the East Coast of the United States.

The domestic and export markets exert their influence at different times and under different combinations of economic, physical, and institutional grain marketing conditions. The Southern and Eastern domestic market areas produce sizeable quantities of corn which normally supply most of their immediate needs. This locally produced supply is usually expended in most years by late December or early January.

During the harvest period, the export market is the dominant market outlet for surplus Ohio corn, while the domestic market is relatively inactive due to a lack of storage for inventorying future needs and/or the adequacy of immediate supplies from local production surpluses.

[1]This research circular is a part of the contribution of the Ohio Agricultural Research and Development Center to Southern Regional Grain Marketing Project SM-42.

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The export market for Ohio grain is handicapped by the freezing of the Seaway in early December. However, the lower unit train rail rates on export grain to the East Coast ports keep this market influence alive throughout the entire winter.

The physical barrier of the Appalachian Mountains increases the difficulty of transporting grain from a multitude of origin points in Ohio by direct routes to the primary deficit areas of the South. Institutional barriers of rail rate territories and the inability of rail lines in the two territories (Eastern for Ohio and Southern for the Southern markets) to establish competitive combination rail rates make trucking surplus corn to Cincinnati (rail head of the Southern lines) a necessity in order to move quantities of corn on a competitive basis into most of the Southern markets. The Ohio River, which could originate barge shipments of corn into the Tennessee River, is not competitive with barge shipments originating nearer the mouth of the Tennessee River. As the supply of surplus barge-shipped corn from southern Indiana and southern Illinois is depleted, the market for rail-shipped corn originating in Cincinnati becomes more competitive.

The function of storage which is necessary to accommodate the *off harvest* movement of corn is dictated by overall market conditions. Since a surplus of corn is produced in Ohio, it could be expected that storage would be provided to serve both the export and domestic markets, both of which typically reflect premiums for stored corn.

The cost of storing corn is generally reflected in the *cash basis* and the amount of the *basis* merely reflects the willingness of buyers in a market to pay these costs. As demonstrated by Hieronymus,[3] these premiums on the average equal the cost of the storage function. Premiums above or discounts below a normal basis reflect the attitude of traders and the need for corn at the time. Storage is not the only cost of holding grain for later consumption. Interest on capital invested in inventories has recently overshadowed the actual storage costs. After the harvest period when storage and interest charges must be considered, the domestic and export markets react according to their needs, and price variations occur.

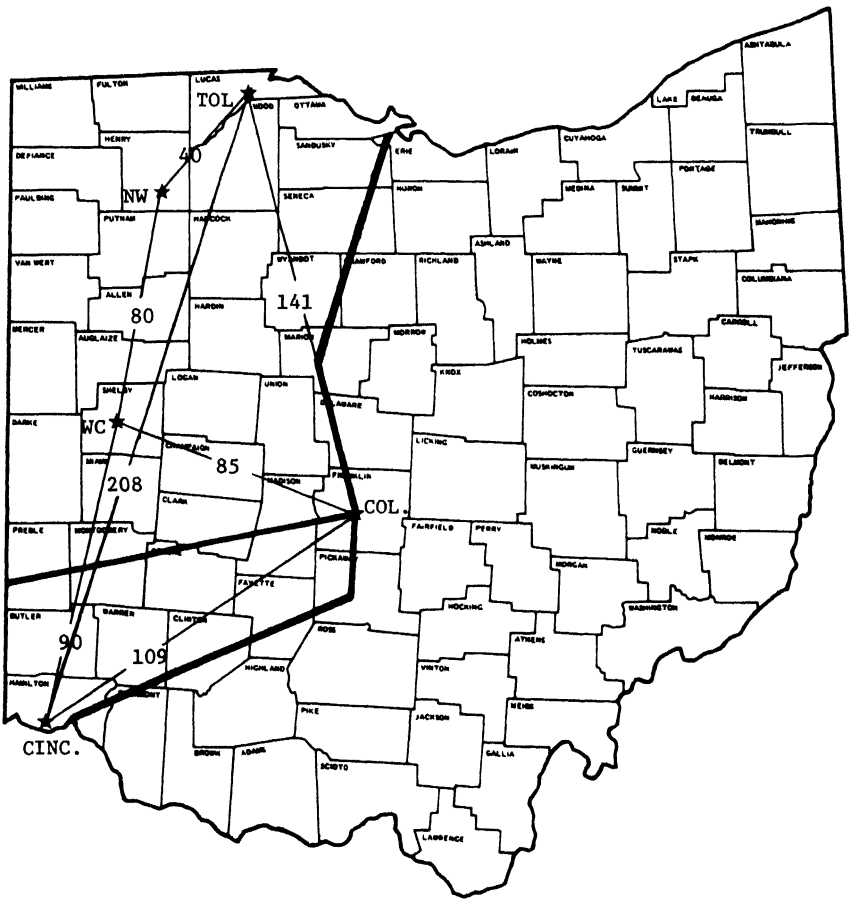
To illustrate the seasonal importance of the above alternative demands on the Ohio market and to describe the seasonal marketing patterns for farmers and elevators, this analysis identifies: 1) the seasonal corn price variation between the Cincinnati and the Toledo markets, 2) the significance of the price advantage of one market over the other if it does exist, and 3) the factors which appear to influence the marketing patterns which result from the price differences.

[3]T. A. Hieronymus, Professor, Dept. of Agricultural Economics, University of Illinois, Champaign.

PROCEDURES AND DATA

To illustrate and compare the seasonal price variations, Ohio was divided into three areas: east, northwest, and southwest (Fig. 1). The eastern area of Ohio is a deficit feed grain production region. Since only limited quantities of grain flow into and out of this area, the economic implications of this grain flow were not considered in the following analysis.

Northwestern Ohio is a surplus corn producing area. The surplus corn from this area is exported via the St. Lawrence Seaway, shipped



WC - West Central
NW - Northwestern

Market Areas
Distances

FIG. 1.—Marketing areas within Ohio.

by rail and truck into the Northeastern United States, and shipped into the Southeastern United States by using a combination of truck and rail facilities. The Toledo market was selected as the market reference point for the northwestern area because it is a major assembly center for grain exported via the Seaway, shipped to Eastern markets by truck and rail, or shipped to export via rail to Eastern U. S. ports.

Southwestern Ohio is a lesser surplus corn producing area than the northwest. Surplus corn originating in the southwestern area flows out of the area by truck, rail, and barge into the Southeastern United States, by rail and truck into the Northeastern United States, and by rail into the East Coast export outlets. Since prices in Cincinnati are influenced to a greater degree by the demand and supply conditions of the Southeastern United States, this assembly point was selected as the market reference point for southwestern Ohio.

To identify the seasonal corn price variations between the Cincinnati and the Toledo markets, weekly price data were collected at elevators in these marketing areas. The data, which represent prices paid to elevator and farm firms, were analyzed on a crop year basis for the period September 1964 to February 1973. This period was selected because mileage and point-to-point rail rates on corn did not become effective in Ohio until 1964.[4]

By using the July futures end-of-the-week closing price as a reference point, an annual crop year *price basis* chart for corn was derived for the Cincinnati and Toledo markets. This technique permits the approximation of the progressive seasonal price relationships between the respective cash markets and the futures markets. The July futures price was selected as the price reference point because this month represents the ending of the crop year storage period for corn. After the seasonal variations were identified, a paired "t" test was applied to determine whether the differences between the means of the selected price bases were significantly different from zero.

Since the observed price difference may require economic explanations, data on flows, storage, and inventories were collected for the year 1970 by personally surveying grain elevators in each marketing area. For any period in which the "t" test results are $\mu_1 - \mu_2 \neq 0$, this flow data are compared with the observed price differentials to formulate a hypothesis to explain the seasonality of the differences.

[4]Milner, Arthur R. 1970. Grain Marketing. West Camp Press, Inc., Westerville, Ohio, p. 187.

RESULTS

The data in the price basis chart (Figure 2) approximate the storage and interest returns for corn as reflected for both market areas for all 9 years. The price spread between the July futures and the cash price widens at harvest time and then narrows as the storage season progresses. At harvest time, the cash price averages 16 and 17 cents under the July futures price for the Toledo and Cincinnati markets respectively. By the end of the storage period, the price basis for Toledo approximates 2 cents under July, while the cash price in Cincinnati is approximately 3 cents above the July futures price. This implies that firms within the Toledo market have received, on the average, 14 cents to support the annual storage function, while those in the Cincinnati market have received 20 cents. These apparent differences, which may be due to the existence of the limited volume of surplus grain in the southwestern area, suggest the hypothesis: all variations in earnings or returns for storage between the two markets are due to random chance. Statistical analysis performed on the above data during a past research project does not support this hypothesis.[5] Hence, it can be concluded that regional price basis patterns do exist between the two terminal markets and that speculation in the corn basis at Cincinnati resulted in significantly greater storage earnings than at Toledo.[6]

To compare and contrast the two seasonal cash market price bases, the crop year was divided into three segments: 1) crop year transition period—August, 2) harvest—September to November, and 3) the marketing period—December through July. The latter division is based upon the approximate closing date of the Seaway and the realization that approximately 55% of Ohio's marketed corn has reached its first destination by late December.[7]

As illustrated in Figure 2, the price spread in the harvesting period tends to favor the Toledo market, while during the marketing period (December to July) the price basis favors Cincinnati. The results of the "paired t test" which tested the hypothesis (HO: $\mu_1 - \mu_2 = 0$) are reported in Table 1. Since both "t" values are significantly different from zero, the hypotheses are rejected and the existing market price differentials must be explained by factors other than chance.

The monthly flow data (Table 1) illustrate that the Toledo market received nearly 60% of its total grain supply (20% per month) during

[5]Spar, R. L. 1972. An Analysis of Cash Basis Patterns of Corn and Soybeans at Five Locations in Ohio for 1964-1971. Unpublished Master's Thesis, Dept. of Agricultural Economics, The Ohio State University, p. 29.

[6]Ibid., pp. 58-59.

[7]Ohio Grain Stocks Report, Statistical Reporting Service, U. S. Dept. of Agriculture, Columbus, Ohio.

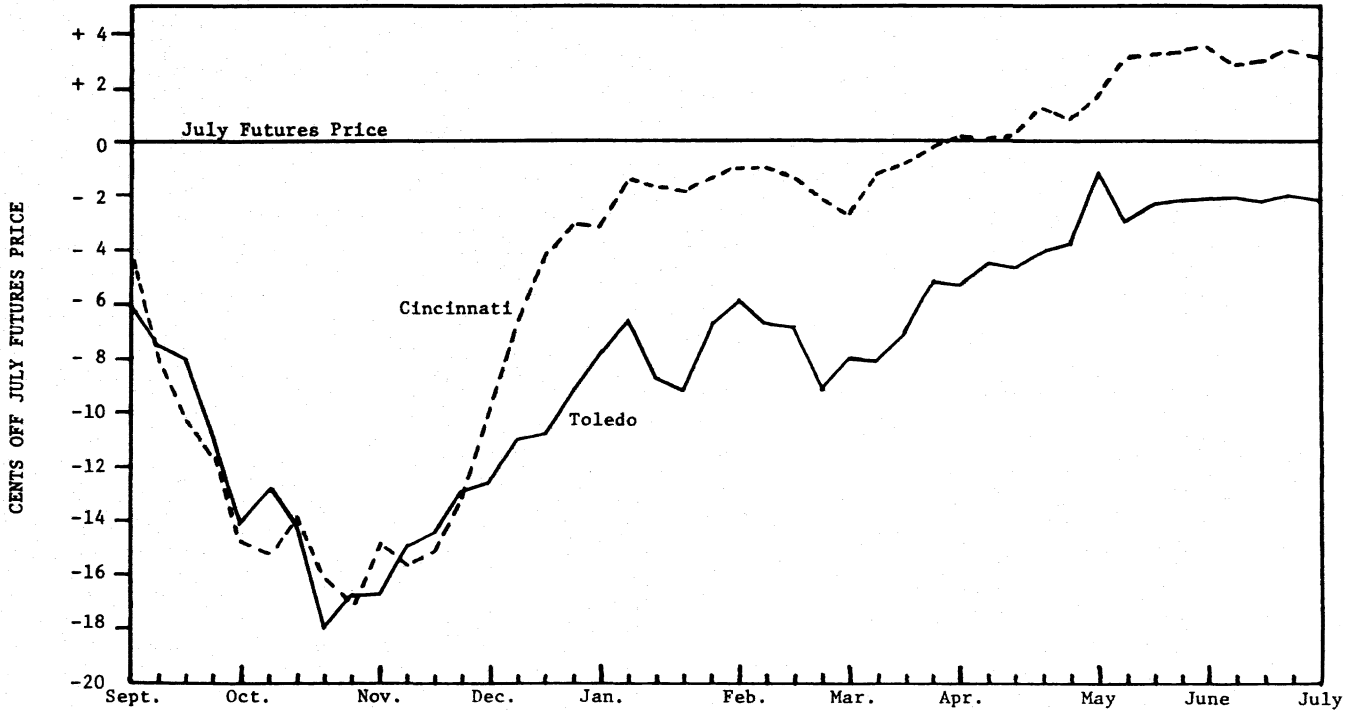


FIG. 2.—Average weekly cash price for corn bid to Toledo and Cincinnati elevators, July futures and basis chart, Sept. 1964-Feb. 1973.

TABLE 1.—Price Differences, t Value, Receipts, and Shipments of Cincinnati and Toledo Markets.

Time Period	Cincinnati —Toledo Price (Cents/Bu.)	t Value	Cincinnati Receipts Percent	Cincinnati Receipts Percent/ Month	Cincinnati Shipment Percent	Cincinnati Shipment Percent/ Month	Toledo Receipts Percent	Toledo Receipts Percent/ Month	Toledo Shipment Percent	Toledo Shipment Percent/ Month
August	+2.25	6.63**	5.3	5.3	7.1	7.1	4.7	4.7	4.2	4.2
Sept.-Nov.	—0.67	2.26*	38.4	12.8	28.0	9.3	58.7	19.5	43.4	14.4
Dec.-July	+4.21	24.81**	56.3	7.0	64.9	8.1	36.6	4.6	52.4	6.6

*Significant (≤ .05).
**Highly significant (≤ .01).

the harvest period. Although Cincinnati receipts increased (over the 9-year period), this market received grain on a more continual basis throughout the year. The rapid increase in grain receipts at Toledo was necessary to meet the existing export demand. For example, firms in Toledo shipped 43.4% of their total shipment (14% per month) during the September to November period. Since receipts exceeded shipments by 5.1% per month, firms within the Toledo market were also filling their storage units fairly rapidly.

During this period, Cincinnati was merchandising grain into the Southeastern and Northeastern United States. Because harvesting is also underway in these areas, demand for Ohio corn would not be relatively strong. Since receipts in Cincinnati exceeded shipments by 3.5% vs. 5.1% for Toledo, the data suggest that Cincinnati was either filling its storage units at a lower rate than Toledo and/or stores smaller volumes of grain. In conclusion, it can be argued that the rapid increase in exports and storage compared with a lack of active demand for Ohio corn in the Southern markets causes the price in the Toledo market to be higher than in the Cincinnati market during the harvesting period.

By early December, the price basis favors Cincinnati. Hence, the market area for Cincinnati starts to expand while the Toledo market area reduces in size. For example, during this period, Cincinnati received 56.3% of its grain while Toledo received only 36.6%. This price inversion occurs because export demand for corn via Lake Erie declines to zero with the freezing of the Seaway. Second, because rail rate price restrictions eliminate the Southeastern United States as a market alternative for corn originating in the Toledo market, firms in the Toledo area can only merchandise corn into the Northeastern United States or through the Eastern export points. Third, the Toledo storage units may be full. Fourth, the disappearance of inventories of locally produced corn in the Southern United States results in an increase in demand for Ohio corn in that region. When the latter conditions happen, the southwestern Ohio supply of surplus grain declines relative to the surplus in the northwestern region. Thus these economic and institutional relationships generate a price structure which forces surplus corn in western Ohio to flow into the Cincinnati market and illustrate the importance of the Southeastern United States corn demand on Ohio markets during the marketing period.

During the transition period (August), the Toledo market is inactive relative to Cincinnati (Table 1). The above economic and institutional relationships again cause the Cincinnati price to be significantly higher than the existing price level in Toledo. However, the

smaller difference signals the end of the current crop year and the approaching new set of price relationships.

IMPLICATIONS

If the existing transportational constraints continue and the supply and demand conditions remain intact, the observed price inversion phenomenon will continue on a seasonal basis within Ohio. This implies that Ohio farmers and local elevator operators who store corn past the harvest season should carefully evaluate prices within both markets. Assuming similar transportation costs between the two markets, farm and elevator firms should find the Toledo market to be the highest price market during the first part of the marketing season and the Cincinnati market the highest price market during the second.

Since it has been proven that the price variations were not due to chance, but to supply and demand factors exerting their force in a predictable manner, farmers and elevator operators who store corn for later sale should carefully evaluate these price variations. They should determine whether the seasonal price advantage which occurs will more than pay for the storage and interest charges incurred from holding the corn to the later periods, plus any additional transport costs. This does not imply that it pays to store grain in the northern areas for sale in the Southern markets at a later period. It does, however, imply that the comparative advantage of one market over the other at that time does prevail.

If the existing price structure does not produce the supplies of corn needed for the Southern markets, the price differences in favor of Cincinnati will increase or the buyers in the Southern market will perform the storage function and may enter the Ohio corn market earlier in the harvest period. Since this study does not attempt to analyze all of the important economic variables, considerable additional work will be required by the Southern Regional Grain Marketing Committee (SM-42) to ascertain the important facts relating to the alternative future market structure within Ohio, the Midwest, and the Southeast.

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Mahoning County Farm, Canfield: 275 acres

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Southern Branch, Ripley, Brown County: 275 acres

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